

THE ROLE OF RENEWABLE ENERGY RESOURCES IN POVERTY ALLEVIATION AND SUSTAINABLE DEVELOPMENT IN NIGERIA.

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ABSTRACT

The estimated amount of renewable energy resources (such as hydropower, biomass, wind power, biogas, solar energy and geothermal power) in Nigeria is enormous and abundantly available. Consequently, the energy industry in Nigeria faces numerous challenges ranging from political, cultural and socio-economic problems etc., which hamper the full development and utilization of these resources for poverty alleviation and sustainable development. This paper reviews the prospects and challenges of integrating the mature and emerging renewable energy resources for poverty reduction and sustainable development in Nigeria and therefore calls for an improved energy conservation and development policy. This should be supported by effective implementation resulting in visible industrialization, employment creation, income generation even in the rural communities and drastic reduction of poverty in the country.

KEYWORDS: renewable energy, energy, poverty, sustainable development, Nigeria

INTRODUCTION

Poverty is the most crucial problem facing developing countries because of its effect on livelihoods. Poverty refers to an individual's (or family's) lack of access associated primarily with inadequate income to basic human needs such as food, shelter, fuel, clothing, safe water, sanitation, health care and education. Poverty is manifested as the inability to achieve a minimum standard of what is needed for material well-being. Human poverty also entails the denial of opportunities and choices most vital to human development-including a long, healthy, creative life, knowledge (access to reading and communication) and a decent standard of living.

The number of Nigerians living under poverty is staggering- over 70 million (NBS, 2009). Thus, poverty reduction is undoubtedly one of the highest ranking issues in the national strategies of many less developed countries and the most potent issue in the current international development agenda.

The energy crisis, which has engulfed Nigeria for almost two decades, has been enormous and largely contributed to the incidence of poverty by paralyzing industrial and commercial activities during this period. The Council for Renewable Energy, Nigeria (CREN) estimates that power outages brought about a loss of 126 billion naira (US\$ 984.38 million) annually (CREN, 2009). Apart from the huge income loss, it has also resulted in health hazards due to exposure to carbon emissions caused by constant use of 'backyard generators' by different households and business enterprises, unemployment and high cost of living leading to deteriorating living conditions.

Moreover, according to the Central Bank estimate in 1985, Nigeria consumed 8,771, 863 tones equivalent of oil (CBN, 1985). This is equal to about 180,000 barrels of oil per day. Since then, oil consumption in Nigeria has drastically increased. The effect of this on the economy relying solely on revenue from oil is tremendous. Also Department for Petroleum Resources, DPR (2007) states that petroleum supply more than 78% of total energy consumption in Nigeria. In the present predicament as a nation, it is obvious that depending mainly on fossil fuel (petroleum) is not enough to meet the energy needs of the country. Since Nigeria is blessed with abundant renewable energy resources such as hydroelectric, solar, wind, tidal and biomass, there is need to harness these resources and chart a new energy future for Nigeria. In this regard, the government has a responsibility to make renewable energy available and affordable to all.

Nigeria's dependence on oil for energy is deepening deprivation in the development of her abundant renewable energy resources, which are environmentally friendly in terms of global warming, air and water pollution, clean and safe, more accessible and affordable energy that will engender sustainable development and also be a source of opportunity rather than oppression for the poor or less privileged and therefore a key step towards poverty reduction in Nigeria.

THE ENERGY-POVERTY NEXUS.

Energy services are paramount to the basic development challenge of providing adequate food, shelter, clothing, water, sanitation, medical care, schooling, and access to information. Although energy is one dimension or determinant of poverty and development, it is very vital. Energy supports the provision of basic needs such as cooked food, a comfortable living temperature, lighting, the use of appliances, piped water or sewerage, essential health care (refrigerated vaccines, emergency and intensive care), educational aids, communication (radio, television, electronic mail, the world wide web) and transport. Energy also fuels productive activities including agriculture, commerce, manufacturing, industry and mining. Conversely, lack of access to energy contributes to poverty and deprivation and can contribute to economic decline. Energy and poverty reduction link is strong and mainly operate through socio-economic development, which involve productivity, income growth, education, health and gender. These issues are explicitly examined below:-

(i) Productivity

Millions of poor people in Nigeria and other developing countries currently consume, on a per capita basis, just 5 percent of the modern energy services consumed by people in high income countries (UNDP,2004) Such inadequacy in energy services has condemned the poor to walk or use animal power instead of travelling by motorized transport. It also means that they must live in poorly lighted and badly heated or cooled homes, and labour without the benefit of powered machines, while also cooking with polluting fuels such as wood and animal dung.

Due to their subsistent existence, the poor might regard any cash payments for modern energy services as “luxury”. Yet, expanding access to modern energy services can alleviate drudgery in the lives of the poor who need energy for basic services such as cooking, lighting, heating, refrigeration, communication, and information. Besides, the poor also need energy to power productivity-boosting equipment that improves their income-earning capabilities. In particular, enhanced access to energy services is important for improving agricultural productivity, not just in terms of volume of crops grown, but also in post-harvest value-added activities such as drying, processing, conservation and timely transportation to markets, all of which require energy.

(ii) Income Growth

Energy consumption shows a strong correlation with national income, so that countries with higher income are also those with higher energy consumption. Economic growth creates employment and raises incomes. Essentially, most economic activity would not be possible without energy as a critical input, and these include the small and medium-scale enterprises (SMEs) that constitute the primary source of new jobs for the poor. Hence, the type of economic growth that creates jobs and raises incomes depends on greater and more efficient use of energy.

(iii) Health and education

Modern energy services enhance the delivery of key social services. For example:

(a) electricity makes it possible to refrigerate vaccines, operate medical equipment, and provide lighting after sunset in health clinics;

(b) in homes, electricity helps to improve children’s educational attainment, even where its use is limited to a single light bulb;

c) energy for pumping and treating raw water makes it possible to provide clean water in Communities; and

d) for poor people everywhere, access to modern energy services frees time for productive ventures, education, and leisure-time that would otherwise be spent collecting traditional fuels or in much less productive manual labor.

(iv) Gender Dimension

Health access, education attainment, and productive activities of women and children are very sensitive to the availability of modern energy services. Modern cooking fuels free women and children from the burden of collecting and carrying large bundles of firewood over long distances and from exposure to harmful fumes from primitive cooking stoves. Improved lighting makes it possible for adults and children to relax and have entertainment after the end of their daytime activities; it also provides a better learning atmosphere for children beyond the hours of sunset. Moreover, electricity enables both women and men in poor households to engage in activities that generate income—by providing lighting that extends the workday and powering machines that increase output beyond subsistence levels.

The lack of modern fuels and electricity also reinforces gender inequalities. Many of the poorest households are headed by women — due mainly to the loss of a male bread winner. Women and girls who are responsible for fuel gathering and cooking are in such situation disproportionately burdened by lack of access to modern fuels and electricity. In addition to the time spent gathering fuels, most traditional staple foods involve a large amount of threshing, de-husking or grinding, which is mostly done through female labour in the poorest households and regions due to lack of access to mechanical power. Many girls are withdrawn from school to attend to such domestic chores, which have significant negative effects on their educational and economic chances. Energy services such as heat for cooking and power for food processing are, therefore, particularly important for women and girls.

ENERGY POVERTY

The energy dimension of poverty-energy poverty may be defined as the absence of sufficient choice in accessing adequate affordable, reliable, high quality and environmentally benign energy services to support economic and human development. The number is staggering: in Nigeria about 70 million people (54.4% of Nigerians) are without clean, safe cooking fuels and electricity and must depend on traditional biomass sources (NBS, 2009) Increased access to such energy services will not, in itself, result in economic or social development; but lack of adequate energy inputs can be a severe constrain on development.

Universally accessible energy services in the form of renewable energy resources that are adequate, affordable, reliable, of good quality, safe and environmentally benign are therefore a necessary condition for sustainable development and poverty reduction.

ENERGY AND SUSTAINABLE DEVELOPMENT

Sustainable development entails the adoption of production and consumption patterns that meet the needs of the present without jeopardizing the goals of future generations. Every country's economy can be described as an integrated energy system that consists of streams of energy-producing and energy-using activities. Energy is central to practically all aspects of sustainable development. Energy is central to the economy because it drives all economic activities. This characterization of energy directs our attention to its sources in nature, to activities that convert and re-convert this energy, and finally to activities that use the energy to produce goods and services and household consumption. Traditionally, energy is treated as an intermediate input in the production process. This treatment of energy's role understates its importance and contribution to development. All economic activities and processes require some form of energy. This effectively makes energy a critical primary factor of production. Given the state of technological advancement in the economy, capital and labor perform supporting roles in converting, directing and amplifying energy to produce goods and services needed for growth and poverty reduction.

Energy thus plays a critical role in social and economic transformation. Lack of access to energy places severe constraints on national development resulting in sub-optimal outcomes where poor people are often the greatest losers. Energy services are essential ingredients of all three pillars of sustainable development — economic, social and environmental. And economies that have replaced human and animal labor with more convenient and efficient sources of energy and technology are also the ones that have grown the fastest. No country in modern times has succeeded in reducing poverty substantially without adequately increasing the provision and use of energy to make material progress. Indeed, by not ensuring a minimum access to energy services for a broad segment of the population, economic development of developing countries such as Nigeria beyond the level of subsistence has proven to be a real challenge.

Emphasis on productive uses of energy services is important in helping people out of poverty. At the national level, energy propels economic development by serving as the launch pad for industrial growth and, via transport and communications, providing access to international markets and trade. Reliable, efficient and competitively priced energy supplies also attract foreign direct investment — a very important factor in boosting economic growth in recent times.

At the local level, energy facilitates economic development by improving productivity and enabling local income generation through improved agricultural development (irrigation, crop processing, storage and transport to market) and through non-farm employment, including micro-enterprise development. As an indicator of local recognition of the importance of energy for businesses, Nigerian manufacturers, who were asked to rank the constraints on their

firms' activities, identified power breakdown and voltage fluctuations as their top two problems (ECN 2008). Recent developments in Ghana's energy sector buttress this point (Ashong, 2001).

Energy also has strong and important links to the environment. Many energy sources are drawn directly from the environment, requiring sound management for these sources to be sustainable. Furthermore, energy use affects the environment. Emissions from fossil fuels, for example, reach beyond the local and national levels to affect the global environment and contribute to climate change. The poorest people often live in the most ecologically sensitive and vulnerable physical locations. These areas may be the most affected by the predictable effects of climate change such as increased frequency of extreme events— such as floods, drought, rising sea levels, and melting ice caps. The risks facing poor people are often increased by the unsustainable use of biomass resources by themselves or others — although more often by the latter group who exploit these resources for commercial purposes.

Use of renewable natural resources combined with efficient supply and use of fossil fuels with cleaner technologies, can help reduce the environmental effects of energy use and help Nigeria and other developing countries grow their economies while also replacing existing, inefficient polluting fossil fuel technologies that pollute the environment. Much as this may seem enticing, the issue of affordability particularly in respect of the poor cannot be taken for granted. As a complementary measure, careful management of energy resources is important to promote economic growth, protect ecosystems and provide sustainable natural resources.

POTENTIALS OF RENEWABLE ENERGY RESOURCES IN NIGERIA.

Nigeria is endowed with large amount of renewable natural resources of which when fully developed and utilized will lead to poverty reduction and sustainable development.

HYDRO POWER

Aliyu and Elegba (1990) indicated that the country is at least; reasonably endowed with large rivers and some few natural falls.

The Rivers, Niger and Benue with several tributaries constitute the Nigerian river system which offers some potential renewable source of energy for economically viable large hydropower development. In addition, several scores of small rivers and streams also exist within the present split of the country into eleven River Basin Authorities, some of which maintain minimum discharge all the year round.

Although construction costs of hydropower are high, the zero fuel cost and low maintenance cost make hydro generation of any size generally a competitive investment in the mix generation of an electric power system (Cassedy and Meier 1988).

SOLAR ENERGY RESOURCES

According to Bala *et al* (2000), Nigeria is endowed with an annual Average daily sunshine of 6.25 hours ranging between about 3.5 hours at the coastal areas and 9.0 hours at the far northern boundary. According to him, Nigeria receives about 4.851×10^{12} kWh of energy per day from the Sun. These huge energy resources from the sun already have a range of applications with various degrees of technical and economic feasibility. This will find application as power supplies to the village and decentralized single dwelling for lighting, refrigeration, direct drive, water pumping systems, and communication equipment.

With health care being extended to remote rural dwellings solar power supplies for remote clinics and hospitals will be of increasing importance.

WIND ENERGY.

Globally, Nigeria is located within low to moderate wind energy zone. Ojosu and Salawu (1990) on their comprehensive nation wide study on wind energy availability and potential in Nigeria appraised the wind energy potential and utilization in Nigeria.

For suitable geographical regions and landscape, wind power generation readily finds application for stand alone operational mode. This is most applicable to remote sites, where costs of transmission and distribution from the grid

are prohibitively high. Such remote sites in Nigeria are often agricultural, wilderness and small village locations with needs for electricity, even if supplied intermittently. In hybrid pumped storage scheme, feasible wind power generation will find further useful application for water pumping and agricultural purposes.

BIOMASS/BIOGAS

The biomass resources of Nigeria can be identified as wood, forage grasses and shrubs, animal waste arising from forestry, agricultural, municipal and industrial activities as well as aquatic biomass.

Plant biomass can be utilized as fuel for small scale industries. It could also be fermented by anaerobic bacteria to produce a very versatile and cheap fuel Gas, i.e. biogas. With fair cost of implementation, the specific units have good prospects for house holds, farms and livestock.

Akinbami *et al* (2001)'s assessment indicated that in Nigeria, identified feedstock substrate for an economically feasible biogas programme includes water lettuce, water hyacinth, dung, cassava leave, urban refuse, solid (including industrial) waste, agricultural residues and sewages. With increasing urbanization and industrialization, the annual Municipal solid waste (MSW) generated will continue to increase. Biogas production may therefore be a profitable means of reducing or even eliminating the menace and nuisance of urban wastes in many cities by recycling them.

GEO THERMAL POWER

The useful conversion of natural heat from the interior of the earth to heat building and generate electricity is an application of geologic knowledge and engineering technology. The idea of harnessing the earth's internal heat is not new. As early as 1904, geothermal power was developed in Italy utilizing dry steam and natural internal heat. Geothermal energy is now being used to generate electricity in Russia, Japan, New Zealand Mexico, Iceland and USA (Loftness, 1979).

Development of geothermal energy resource is yet to commence in Nigeria. (Adegbuyi *et al*, 1990). It is however noted that potentials for Geo-pressured systems and hydrothermal systems, may be available in some of the Nigeria Basins e.g. Benue through the Niger Delta (Adegbuyi, 1989, Adegbuyi *et al* 1996)

OTHER RESOURCES

Presently, the potentials of some of the resources like waves, tidal and ocean thermal gradients still remain unqualified (Garba and Bashir, 2002)

LIMITATIONS TO THE DEVELOPMENT OF RENEWABLE ALTERNATIVE ENERGY RESOURCES IN NIGERIA

The development of renewable/alternative energy resources in Nigeria has been limited by a number of factors, which include:

- A. Cultural Religious and Traditional Issues: - Rejection of new energy may sometimes arise from cultural taboos. Certain new energy involves known taboos in certain part of the World e.g. the use of human excreta in Biogas production in some parts of Africa.
- B. Technology: - Apart from solar thermal and Biogas technology, the required technology to develop and tap other forms of renewable energy technologies is lacking in Nigeria. Most of the technologies are being imported thereby escalating the already high investment cost.
- C. Inadequate Funds: - Lack of funds thwarts the development of new energy resources. Public funds are limited and the absence of any serious private sector participation in the development and dissemination of the technology poses a serious barrier to renewable energy technologies.
- D. High Cost of Energy Infrastructure: - Small scale hydropower, central and residential solar photovoltaic technologies, etc have not penetrated Nigeria's energy supply systems, because of their relatively high investment cost.
- E. Political Factor: - Centralization is a problem, for new fuels are usually scattered and produced on a relatively small scale. There is also the preference for advanced technology in developing countries. Also political zeal to implement desirable energy options is a major limitation, because of political interest.

- F. Low Level of Public Awareness: - Public awareness of renewable energy resources and technologies in Nigeria and their benefits, both economically and environmentally are generally low; thus, hampering the development, application and dissemination of renewable energy resources and technologies in the national energy market.

RECOMMENDATION

- i. There is need for private sector participation and funding of renewable energy research and development in Nigeria.
- ii. Development partners such as DFID, UNDP, UNICEF, WORLDBANK etc. should be involved in the sponsorship and provision of loan for sustainable development and utilization of renewable natural resources. Developing countries such as India, Tunisia, Morocco, Indonesia and Mexico have benefited immensely from these partners in their solar energy projects.
- iii. Since the lack of access to affordable, clean and convenient energy is strongly linked to poverty, it is recommended that a comprehensive resource survey and assessment be carried out to determine the total renewable energy potential in the country as well as identify local conditions and priorities in various ecological zones.
- iv. Government at all levels should make adequate provision for research grants in renewable energy resources to make production cheaper and generation more efficient.
- v. The development of renewable energy technologies is linked to many other sectors such as agriculture, small scale industrial enterprises and poverty alleviation, it is recommended that, renewable energy related projects have a greater likelihood of success if implemented in accordance with activities in these sectors to ensure sufficient demand for the energy services providers.
- vi. Recognizing that current flow on renewable energy technologies is inadequate, it is recommended that demonstration projects on various renewable energy forms be widely established; so that the performance and efficiency with which services are delivered can be sensitized.
- vii. Entrepreneurship and managerial skills development training programme and technical courses in renewable energy technologies with a view of creating self employment and developing Energy Service Companies (ESCOs), providing services to rural areas be introduced.

CONCLUSION

Renewable energy resources if fully developed and utilized can be a veritable tool for poverty reduction and sustainable development in Nigeria. Poverty reduction is undoubtedly one of the highest ranking issues in the policy strategy of the Nigerian government. For this objective to be actualized, government must harness the potentials of renewable energy resources that are abundant in various geographical zones of the country. Given due consideration to both the technical, political and economic viability of its application, renewable energy can be utilized to meet the challenges posed by the present energy crisis.

Therefore, measures must be taken by the government at all levels to make adequate policies in effective exploitation, management and utilization of our renewable energy resources in order to reduce dependence on fossil fuel. This will go a long way in providing opportunities for the less privileged and result in income generation and improved standard of living.

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